

CHAPTER 9

SPECIAL APPLICATION REQUIREMENTS

9.1 INTRODUCTION

Preceding chapters of this handbook have discussed the general requirements of high-efficiency air cleaning systems as they pertain to relatively common applications. This chapter discusses special requirements that may have to be considered for certain applications, including remote handling of filters and/or adsorbers, shielding, designing to resist natural phenomena such as a tornado or earthquake, high-capacity sand filters, Engineered Safety Feature (ESF) systems, and considerations for radiochemical plant ventilation and off-gas systems.

9.2 REMOTE MAINTENANCE OF HOT CELLS

In some radiochemical, fuel reprocessing, and post-accident reactor cleanup applications, radiation levels may be so high that direct access and contact maintenance are impossible. Therefore, servicing and replacement of filter and adsorber cells must be accomplished remotely. Remotely maintainable systems must achieve the same high collection efficiency and reliability objectives as other installations, but design and construction are often complicated by the necessity for radiation shielding and the need to manipulate clamping devices and handle components indirectly and from a distance. Federal regulations specify a maximum exposure to personnel in restricted areas of 3 rem to the whole body and 18.75 rem to the hands and forearms in any calendar quarter.¹ If radiation levels in filters or adsorbers approach, or could potentially reach, these levels, contact maintenance may be prohibited and consideration must be given to remote procedures.

Radiation exposure can be minimized by limiting exposure time, by attenuating the radiation via shielding, and by reducing the intensity of

exposure by keeping a safe distance from the source (intensity follows the inverse square law). A practice in some low-to-moderate hazard systems has been to limit exposure time by sending workmen into contaminated housings in relays. Such procedures run the risk of exhausting the permissible radiation allowance of personnel so that their availability for work in other contaminated areas of the plant is limited. Even in borderline cases, it is advisable to consider remote maintenance.

Specific recommendations concerning how remote maintenance should be accomplished cannot be made. Of the systems built to date, approaches to the problem have varied widely. The installations described below are representative of and illustrate some of the problems and factors that must be considered in designing such systems.

9.2.1 GENERAL CONSIDERATIONS

Clamping devices and the components (filters, adsorber cells) of remotely maintained systems are handled by special extended-reach tools; electromechanical manipulators; solenoid-, pneumatically-, or hydraulically-actuated devices; cranes; or other indirect means. In some systems (**FIGURES 9.1 through 9.12**), filters are installed on a removable mounting frame that is replaced as a complete assembly using a crane. In three of the systems illustrated, the entire housing is replaced. In most cases, housings will be enclosed in concrete vaults or pits with heavy concrete plugs to seal access ports. Designers must recognize that workmen do not have the close control over movement of tools, equipment, and components that they do in direct-access contact-maintenance systems. Careful attention must be paid to filter (adsorber) withdrawal and handling space and, if alignment guides are not provided, access ports must be generously sized to permit the easy